The output from the laser pick-up is a stream of electrical pulses in 16-bit PCM code. In the Digital/Analogue converter this stream is decoded, word by word, and synthesised into the conventional form of stereo audio signal. But this signal is more exact and more powerful than the output of an electromagnetic pick-up, because of the digital technique used – a much more accurate procedure than deflecting a stylus in the groove of a conventional record.

The decoder, in fact, checks each word to see that it is correctly formed and avoids errors by correcting any that are not. By reconstructing the decoded sound-values the words synthesise an audio signal which exactly represents the information on the disc. And this signal, unlike that of the electromagnetic pick-up, can be set at an optimal amplitude for subsequent amplification. It then only remains to feed it through the audio amplifier to the loudspeakers.

CD – Technical data

Achievable audio performance	
Number of channels	2 or 4[1])
Frequency range	20 Hz - 20 kHz
Dynamic range	> 90 dB
S/N ratio	> 90 dB
Channel separation	> 90 dB
Harmonic distortion	< 0.05%
Wow and flutter	Quartz crystal precision

Signal format	
Sampling frequency	44.1 kHz
Quantization	16 bits linear/channel
Encoding	2's complement
Error correction system	Cross Interleave Reed Solomon Code (CIRC)[2])
Modulation system	Eight to Fourteen Modulation (EFM)[3])
Bit rate	4.3218 Mbits/sec.

Frame Format	
12 data words of 16 bits	: 24 symbols of 8 bits
4 error correction parity words of 16 bits	: 8 symbols of 8 bits
Control and display symbol	: 1 symbol of 8 bits
Frame before modulation	: 33 symbols of 8 bits
Frame after modulation (EFM) (33 symbols of 14 bits)	: 462 channel bits
Symbols for multiplexing and LF suppression (3 bits per symbol of 14 bits)	: 99 channel bits
Synchronisation pattern incl. 3 bits for multiplexing and LF suppression	: 27 channel bits
Total frame	: 588 channel bits

Error correction	
Maximum correctable burst length	4000 bits (≈ 2.5 mm)
Maximum acceptable burst length (by combined error correction and interpolation	14000 bits (≈ 8.4 mm)

Disc	
Diameter	120 mm
Thickness	1.2 mm[4])
Diameter of centre hole	15 mm
Programme area start diameter	50 mm
Programme area maximum diameter	116 mm
Sense of rotation (seen from reading side)	anti-clockwise
Scanning velocity	1.2 - 1.4 m/sec
Rotation speed	500 - 200 rpm (approx.)
Maximum recording time	60 min. stereo[4])
Track pitch	1.6 µm
Material	Transparent plastic, with aluminiumised reflective coating, sealed with protective lacquer

Optical stylus (laser)	
Wave length of AlGaAs laser	0.78µm
Numerical aperture	0.45
Focus depth	Approx. 2µm
Beam diameter at disc surface	Approx. 1.0 mm

[1]) 4 channels with reduced recording time.

[2]) CIRC: new error correction code for protection against scratches, with high error correction capability for random errors and low probability of undetectable errors.

[3]) EFM: new modulation method for increasing packing density and meeting requirements of optical servo systems.

[4]) Single sided disc (double sided disc optional).

COMPACT disc DIGITAL AUDIO

Compact Disc – The optimised digital audio system

CD uses a light beam similar to VLP Laservision – the video long play disc system now coming into use with television. An immediate and obvious question arises: Why should CD and VLP Laservision not use the same parameters? The answer is quite simple: the applications are totally different. Each system has its own specific requirements and objectives. The basic difference between the two systems lies in the considerably higher information content required for a combined picture and sound signal as compared with a sound signal only. The VLP disc is the same size as an LP, the player is relatively large and the system is expensive by audio standards. To use VLP Laservision, even in simplified form, for HiFi sound reproduction is no logical solution. Moreover, a world standard is not feasable because of the various non-compatible TV-systems. It is doubtful whether such a system could ever replace the conventional LP and record player.

With these factors in mind, CD has been developed specifically for sound. It displays the full advantages of the light beam/PCM technique as applied to HiFi reproduction; extended technical performance; attractively compact dimensions; prices in the same bracket as present-day LPs and record players. The size of the CD disc, coupled with its protection against influence from dirt and damage, even makes it suitable for mobile or in-car use.

CD, designed for the purpose, is without doubt the finest system ever developed for sound reproduction.

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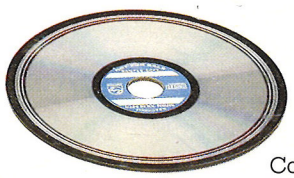
VLP Laservision player

CD player, early development demonstration model

VLP disc



Compact disc

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